ARTBA

American Road & Transportation Builders Association

INTERNAL TRAFFIC CONTROL PLANNING FOR WORK ZONE SAFETY

AVOIDING RUNOVERS/ BACKOVERS IN WORK ZONES

Student Workbook

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PREFACE

Why This Training Is Important

OSHA makes employers responsible for training workers in hazard recognition and avoidance and applicable regulations (Education & Training Standard 1926.21). OSHA also requires employers to train in the special hazards and procedures of each jobsite.

Training is an important hazard control measure.

This program is designed to provide comprehensive training in strategies and practices for prevention of runovers and backovers in road construction work. If you complete this training program, you will be better able to protect yourself and your coworkers as you perform your jobs each day.

Many OSHA standards explicitly require employers to train employees in the safety and health aspects of their jobs. Some OSHA standards make it the employer's responsibility to limit certain job assignments to employees who are *certified*, *competent*, or *qualified* - meaning that they have had special previous training, in or out of the workplace. The term *designated* personnel means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

These requirements reflect OSHA's belief that training is an essential part of every employer's safety and health program for protecting workers from injuries and illnesses. Many researchers conclude that those who are new on the job have a higher rate of accidents and injuries than more experienced workers. If ignorance of specific job hazards and of proper work practices is even partly to blame for this higher injury rate, then training will help to provide a solution. But, no matter how experienced or well trained workers are, there is always something more to learn. That is why it is important for workers to receive *refresher training* periodically to ensure they retain the knowledge and skills needed to perform the job safely and productively.

It is usually a good idea for the employer to keep a *formal record* of all safety and health training. Records can provide evidence of the employer's good faith and compliance with OSHA standards. Documentation can also supply an answer to one of the first questions an accident investigator will ask: *Was the injured employee trained to do the job?*

Training in the proper performance of a job is time and money well spent. Employers and workers regard training as an investment rather than an expense. An effective program of safety training for workers can result in fewer injuries and deaths, better morale, lower insurance premiums, and increased productivity.

MODULE 1

Principles of Internal Traffic Control

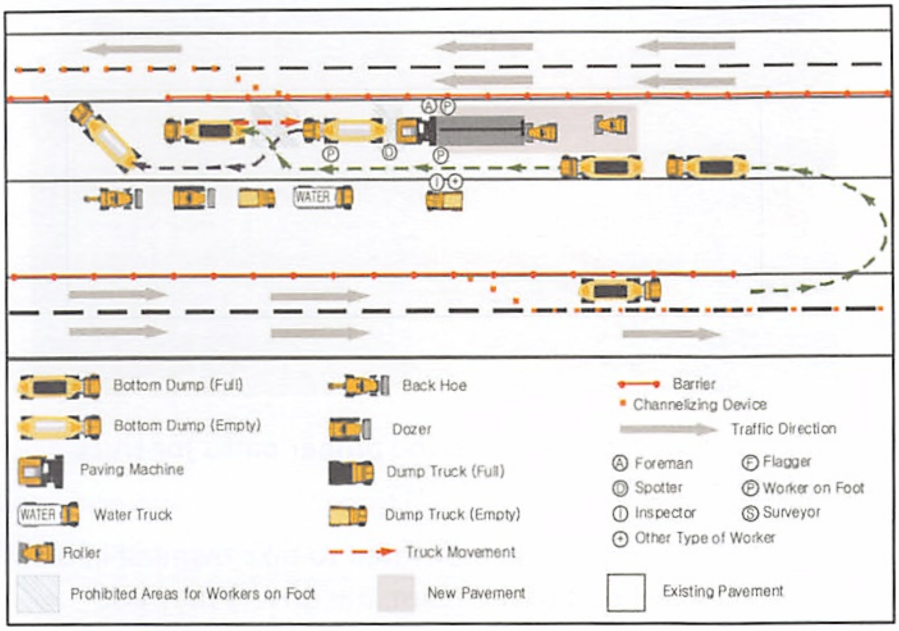
At the end of this unit, you will know

1. **Meaning of 'Internal Traffic Control' (ITC)**
2. **How ITC works**
3. **Differences between ITC and TTC**
4. **Why ITC is needed**
5. **Causes of most work zone fatalities**
6. **How to prevent fatalities from construction vehicles**
7. **How to prevent fatalities from motorists**

If you understand the purpose and function of the Internal Traffic Control Plan, everyone in the work zone will be safer.

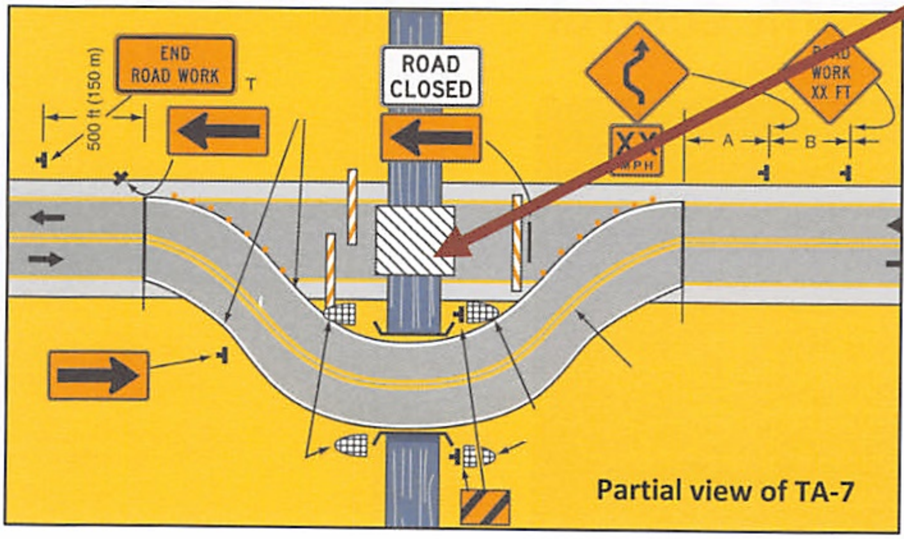
1. What Is the Internal Traffic Control Plan (ITCP)?

The internal traffic control plan (ITCP) is a process used by project managers and others with production responsibility for roadway construction projects. The ITCP is used to coordinate and control the flow of construction vehicles, equipment, and workers operating in close proximity within the work space to ensure the safety of workers.


A
P
P
D
P
I
+
WATER
Bottom Dump (Full)
Bottom Dump (Empty)
Paving Machine
Water Truck
Roller
Prohibited Areas for Workers on Foot
Back Hoe
Dozer
Dump Truck (Full)
Dump Truck (Empty)
Truck Movement
New Pavement
Barrier
Channelizing Device
Traffic Direction
Ⓐ Foreman
Ⓓ Spotter
Ⓘ Inspector
⊕ Other Type of Worker
Ⓕ Flagger
Ⓟ Worker on Foot
Ⓢ Surveyor
Existing Pavement

Internal Traffic Control coordinates construction traffic inside the ACTIVITY AREA of a temporary traffic control zone. The ACTIVITY AREA is where construction work takes place. It is shown as a hatched box on temporary traffic control plans and 'typical applications' in the Federal Highway Administration

Manual on Uniform Traffic Control Devices (MUTCD). Internal Traffic Control Plans (ITCPs) fill in the details on how construction traffic should be set up inside this hatched box.



Partial view of TA-7

2. Overview of Internal Traffic Control Plans (ITCPs)

In simple terms, ITCPs are a protocol to inform all parties operating within the work space about the locations of others. ITCPs create 'zones' designed to minimize interaction between workers on foot and construction vehicles by designating routes and operating procedures for large trucks delivering materials inside the 'cone zone." The ITCP creates a traffic pattern to minimize backing by construction vehicles/equipment.

An effective plan enables communication among all work zone parties in advance of arrival to the construction site.

3. How Does an ITCP Work?

The key functions of ITC are

- Limits work zone access and egress points
- Coordinates truck and equipment movements
- Provides information on traffic paths and safe or unsafe areas for workers

The ITCP makes sure all parties know the locations of access points and the proper paths for truck and equipment movement, including pickup trucks and other work vehicles.

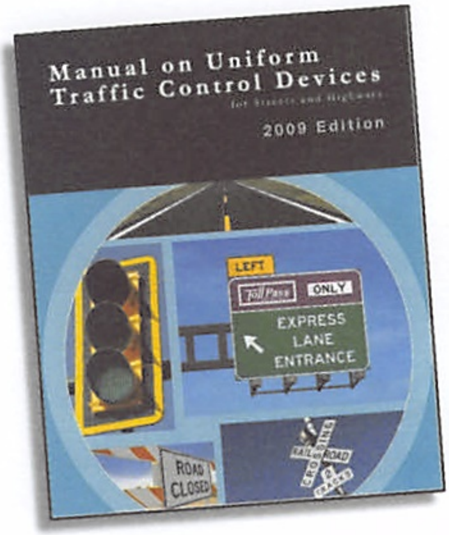
When construction drivers understand there is an ITCP, they will be motivated to take ownership of the program and contribute to its success. When they feel part of the team, the drivers may also provide input if they see a problem.

Drivers rarely receive a 'thank you' for their efforts, and expressions of gratitude for safe performance can go a long way toward getting their buy-in and cooperation. Once all parties understand how an ITCP operates, they will better understand the instructions and verbal communications used to explain daily plans and changes.

4. What Is the Difference Between TTC and ITC?

The key differences between Temporary Traffic Control and Internal Traffic Control are

- TTC Plans move motorists safely through the work zone
  - TTC Plans are required by federal regulations and prescribed in the U.S. Federal Highway Administration *Manual on Uniform Traffic Control Devices (MUTCD)*
- ITCPs prevent workers on foot being struck by construction vehicles within the ACTIVITY AREA of the work zone
  - ITCPs are an industry-recommended best practice and not prescribed by law or regulation


Manual on Uniform
Traffic Control Devices
for Streets and Highways
2009 Edition
LEFT
ONLY
EXPRESS LANE ENTRANCE
ROAD CLOSED
RAILROAD CROSSING

alliance
INTERNAL TRAFFIC
CONTROL PLANS
DO NOT ENTER
TRUCK
ONE WAY
STOP
PEDESTRIAN PROHIBITED
WRONG WAY

TTCPs to guide traffic are *required* by federal regulations. ITCPs to prevent runovers is an industry *best practice*. The movement of workers and equipment within the work space should be planned in a manner similar to the way the TTC plan guides road users through a work zone. Whereas Temporary Traffic Control Plans focus on moving traffic safely through a work zone, Internal Traffic Control Plans (ITCPs) focus on preventing workers on foot being struck by construction equipment and large trucks.

Compare and contrast the differences between temporary traffic control and internal traffic control in the chart on page 4. One significant contrast between TTCPs and ITCPs is that TTCPs are a formal document and changes may require engineering judgment. ITCPs are informal plans and should be changed regularly as site conditions change.

Other differences between TTCPs and ITCPs include

Temporary Traffic Control Plan	Internal Traffic Control Plan
Motor Vehicles	Construction Equipment
FHWA MUTCD or State Guide	NIOSH Development Guide
Typical Applications	ITC Diagrams
Typical Application Notes	Internal Traffic Control Notes
Traffic Safety Engineer	Supervisor/Site Superintendent

5. What Do ITCPs and TTCPs Share in Common?

TTCPs and ITCPs encompass common principles, including

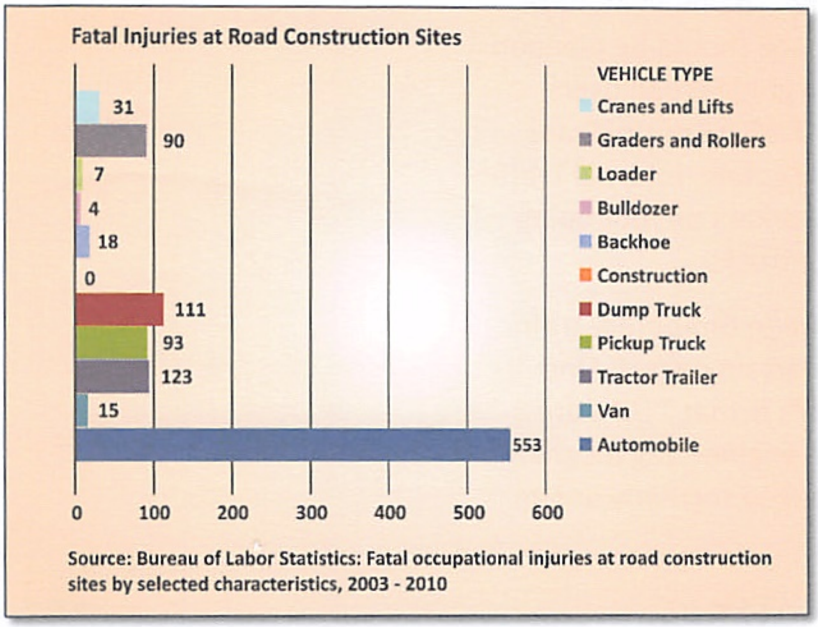
- Provide clear direction to drivers
- Separate moving vehicles from workers on foot
- Use temporary traffic control devices (TTCDs) to mark traffic paths
- Maintain a smooth traffic flow

6. Why Implement Internal Traffic Control?

ITCPs protect workers on foot. Workers on foot or pedestrian workers do most of their work outside vehicles and equipment. They are particularly vulnerable to being struck by vehicles and equipment. ITCPs also reduce hazards for equipment operators.

There are two types of runovers/backovers

- Workers struck by motorists
- Workers struck by construction equipment or vehicles



Source: Bureau of Labor Statistics: Fatal occupational injuries at road construction sites by selected characteristics, 2003 - 2010

Construction equipment and vehicles cause about one-third of all work zone fatalities. On average, 130 workers are killed in struck-by incidents on roadway construction sites each year. Greater industry and public education needs focus on eliminating distractions, such as cell phone use, which can contribute to these deaths and injuries. ITCPs can protect against accidents caused by construction vehicles – and can help reduce fatalities due to motorists.

NOTES

One-third of work zone fatalities are due to struck-by accidents involving construction vehicles and equipment. Coordination of workers and equipment doing different activities in close proximity can improve work flow and reduce conflicts between workers on foot and equipment operators.

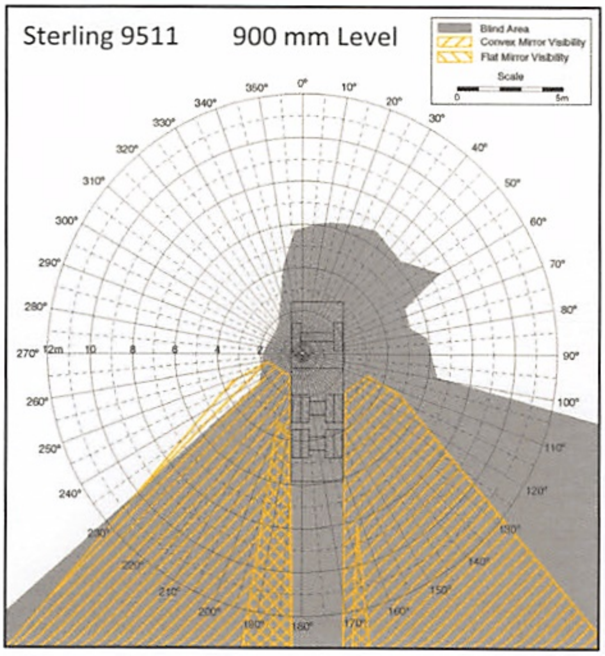
Construction vehicles are the greatest hazard. Compliance with the U.S. Federal Highway Administration *Manual on Uniform Traffic Control Devices (MUTCD)* and OSHA regulations is a necessary first step in providing a safe work environment. However, these sources, taken together, do not provide comprehensive guidance to ensure worker safety in roadway work zones. The interaction between workers on foot and construction trucks and equipment is the single biggest hazard in the heavy and highway industry. There are several specific hazards workers should be aware of to enable them to protect themselves against work zone runover/backover hazards.

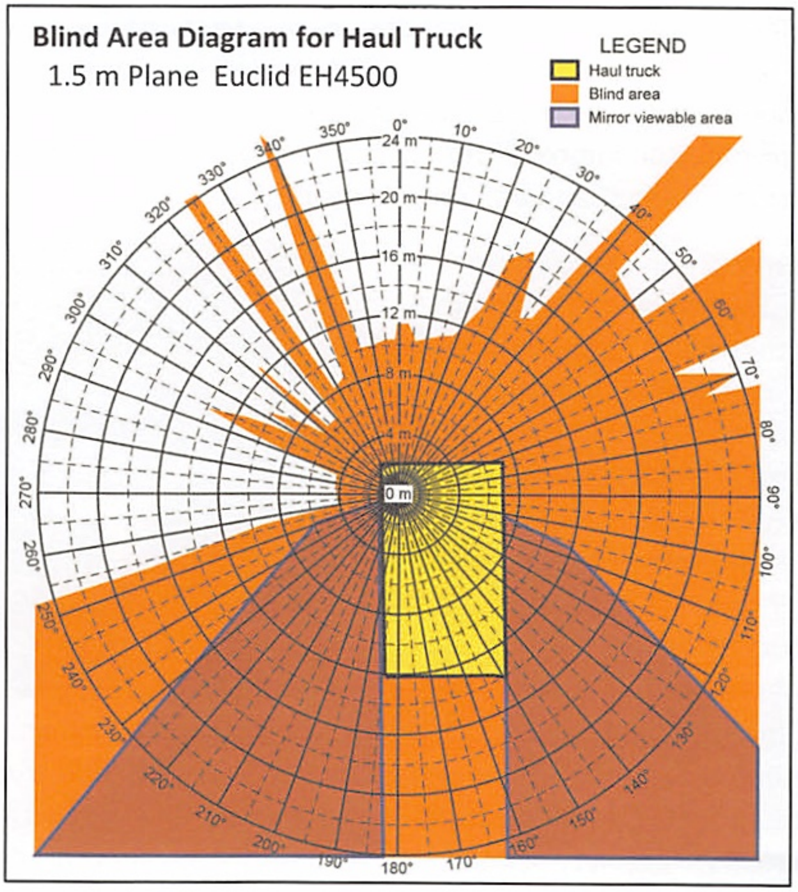
Construction Vehicles

Vehicles frequently enter and exit the ACTIVITY AREA. The constant movement of vehicles in and out of the work area can create hazards if the travel paths are not set and coordinated. ITCPs can also be used to communicate the need to keep entry and exit points free of parked vehicles and equipment. Ideally, ITCPs will minimize backing and turning. Start each day with a risk assessment discussion with workers and subcontractors (including employees).

Workers on foot may work close to large vehicles. Because workers are relatively short compared with construction vehicles, it can be difficult or impossible for drivers to see them, especially in areas known as *blind spots*.

A *blind spot* (or blind area) is the area around a vehicle or construction equipment that is not visible to the operator, either by direct line-of-sight or indirectly by use of internal and external


Sterling 9511
900 mm Level
Blind Area
Convex Mirror Visibility
Flat Mirror Visibility
Scale
0
5m
12m
10
8
6
4


Blind Area Diagram for Haul Truck
1.5 m Plane Euclid EH4500
LEGEND
Haul truck
Blind area
Mirror viewable area
24 m
20 m
16 m
12 m
8 m
4 m
0 m

mirrors. As a worker on foot, if you cannot see the driver and the driver cannot see you, you are in a dangerous situation. Companies and projects should identify a specific side of the vehicle where a worker should always walk for each operation.

Blind spots can be reduced by properly setting mirrors on equipment in a "mirror check station."

Workers on foot should be familiar with the unique blind spots of each vehicle. Each vehicle has its own, unique blind spots. Operators should be familiar with the blind spots surrounding each type of equipment he or she operates and should be sensitive to the fact that workers and other objects cannot be seen – even when using mirrors.

Note the shaded areas in the diagrams at top indicating shapes and sizes of blind spots. The hatched lines show areas visible in the mirrors. More examples of blind spot diagrams for different vehicles are available at: http://www.cdc.gov/niosh/topics/highwayworkzones/BAD/imagelookup.html

Motorists

Workers are also struck and killed by motorists. The second highest cause of deaths is workers being struck by motorists or when a vehicle crashes. Motorists are likely to enter the work space when

- Workers are not visible to motorists
- Motorists are surprised by the work zone and the Temporary Traffic Control Devices (TTCDs)
- The TTCDs are confusing or non-compliant
- Motorists ignore warnings
- Motorists are distracted or impaired (phones, food, drugs, alcohol, drowsy, etc.)
- Traffic is traveling at high speed through work zone

In situations where motorists strike workers, those in the construction industry often assume the fault is with the motorist. The design and execution of the TTCP must be effective so that our work is not a contributing factor. Improper TTC design and workers straying into the traffic space are often cited as causes of worker fatalities. One of the most common reasons motorists stray into the work space is because they are impaired, distracted, or speeding.

Workers may stray into traffic when
- They are preoccupied by work
- They become comfortable in the dangerous environment
- There is no convenient access to and from the work space for
  - -Rest rooms
  - -Food and water
  - -Shade breaks
  - -Other local work areas
  - -Staging of company and personal vehicles
- Workers cross traffic lanes – especially in high-speed locations

The organization of the work space can and does impact worker behavior. Workers are more likely to take risks such as entering the traffic space if circumstances entice or compel them to do so. When creating your ITCP, consider the locations of rest areas, water stations, parking, etc. To the extent feasible, these should be located to minimize workers crossing traffic or construction vehicle pathways.

To prevent deaths caused by motorists, properly set up all Temporary Traffic Control Devices (TTCDs)
- Comply with the MUTCD or the corresponding state document
- Inspect and maintain TTCDs
- Ensure only a qualified engineer makes necessary modifications

Set up safe procedures for deployment and retrieval of TTCDs. Ensure sufficient TTCDs for all parts of the project (ramp geometry, exits, closures, etc.). Depending on the nature of the work, TTCDs may be set up by the site workers or, on more complex or large jobs, this will be accomplished by a specialized contractor or crew. In any situation, TTCDs should be set up in compliance with the *Manual on Uniform Traffic Control Devices* (MUTCD) or comparable document. TTCDs not only provide guidance for traffic, but are part of the worker safety strategy.

Always use TTCDs properly. To use TTCDs properly

- Make workers aware of TTCDs in their work location
- Train workers to notify their supervisor if TTCDs are
  - Not in the proper position
  - Damaged or dirty
  - Not being observed or recognized by motorists

ROAD WORK AHEAD
RIGHT LANE CLOSED

Workers may correct misaligned TTCDs if it is safe to do so and they understand where a TTCD is supposed to be positioned. Workers should be able to recognize if TTCDs are out of place. They should be informed if they have the authority to re-set misaligned TTCDs or of the process for notifying their supervisor when they see a problem. In all situations, misaligned, missing, or non-performing TTCDs should be corrected immediately.

7. Workers Should Know Basic TTCP and ITCP Concepts

Most workers will not be trained to set up and maintain TTCPs or ITCPs. But workers should understand the purpose and function of both plans so they can recognize whenever setups are not functioning.

Module 2

Protecting Workers on Foot

At the end of this unit, you will know

1. **Safe practices for workers on foot**
2. **Safe practices for drivers and operators**
3. **How to set up Worker-Free and Equipment-Free zones**
4. **How to control parking and staging of vehicles, vehicles entering the work space, and truck queues**

Protecting workers on foot is the primary purpose of an ITCP.

Communicate ITCP with Workers

Workers, operators, and other drivers navigating the work space need to know planned routes and locations for equipment and delivery vehicles before they arrive on site.

Fundamental information about the ITCP should be provided to key personnel on the project – including inspectors, subcontractors, and vendors. This could be done with paper copies, radio communications, or even using a phone or other mobile device.

During construction, the safety officer, site supervisors, and foremen should update and review the ITCP with workers daily. Subcontractors should be required to attend ITCP briefings. The ITCP should be consulted when reviewing construction progress and adapting to the daily changes that are routine with all projects. The plan is useful in showing the project owner and personnel that worker safety is being addressed. The primary objective of all these efforts is to inform workers of the hazards present to they can stay clear of danger.

1. Safe Practices to Protect Workers on Foot

The main categories of safe practices are

- Worker habits and behaviors
- Worker visibility
- Operators confirm approach
- High risk mitigation.

Each category is presented in more detail on the next pages.

Worker Habits and Behaviors

The organization of the work space can and does impact worker behavior. Workers are more likely to take risks such as entering the traffic space if circumstances entice or compel them to do so. When creating an ITCP, consider the location of rest areas, water stations, parking, etc. To the extent feasible, these should be located to minimize workers crossing traffic or construction vehicle pathways.

For example, where are workers likely to stand or congregate? On hot days, is there shade nearby? Where are the latrines? Where might workers stand when cold? If raining? If workers are likely to walk to a location, is there a safe route to get there? A good ITCP will address such considerations.

Radio and cell phone use happens more and more. Can workers use phones on the job? How does the foreman communicate with all the other parties? When talking on the phone in a busy, noisy environment, people often plug the ear away from the phone and look to the ground to concentrate on the call.

When they do this, they will not see dangers or hear alarms. How might the ITCP control for this typical behavior? Can a place(s) be designated for making calls? Human factors play a key role in ITCP development and should be considered carefully.

Worker Visibility

Workers must be visible against the surroundings with high visibility garments.

Workers must be visible in a variety of conditions – especially at night, in other low-light conditions, and in inclement weather.

Spotters should be used when backing is required near workers on foot.

Construction equipment is typically large and has an enclosed cab. Characteristics like these can make the blind spots very large and difficult for the operator to see. Also, the size of construction vehicles and equipment often places truck drivers and equipment operators high above the ground. They cannot see workers on foot crossing close in front of them.

ANSI A10.47 *Work Zone Safety for Highway Construction*

ANSI standard A10.47 addresses issues of worker visibility in roadway work zones.

This is a worker safety standard specifically defining roadway construction terminology and best practices in the following areas:

- Traffic Control
- Flagger Safety
- Runover/Backover Prevention
- Equipment Operator Safety
- Excavation
- Electrical/Power Tool Safety
- Fall Prevention
- Materials Handling
- Health Hazards
- Night Work
- Personal Protective Equipment

Workers must be clearly visible to drivers and operators. High visibility garments are now required garments are now required by both FHWA and OSHA for all workers, not just those exposed to motorists and other on-road traffic. These agencies require workers to be dressed in a minimum **ANSI Class II vest**. The makeup of these vests is explained in a standard called

ANSI/ISEA 107
American National Standard for High-Visibility Apparel

The **ANSI/ISEA 107** standard also recommends high visibility hard hats to improve worker visibility. **ANSI/ISEA Class III garments** are highly recommended for flaggers and for all workers during nighttime hours, inclement weather and other low-light conditions.

Operators Confirm Approach

Operators must confirm before workers approach equipment. Workers must wait for a clear signal from the operator before approaching. Otherwise, it is difficult for workers to tell if the operator is looking at them. The worker may think the operator is looking at him or her and that it is safe to approach when in fact the operator is focused on something else.

Before approaching a vehicle, wait for a clear signal from the operator that you have permission to do so.

High Risk Mitigation

The majority of construction activities are regular and relatively safe. Operations become more risky when the ordinary changes, such as when there is a change in the operational process, the asphalt plant

High Risk Mitigation (Continued)

breaks down, the operation is in tight quarters (i.e. aprons, bridges, drainage areas), and mobilizing to begin a new lift of asphalt. All these operations cause modifications to the normal plan. Certain situations create high risks – such as

- Trucks back more frequently
- Workers on foot are closer to equipment
- More equipment or vehicles are on site and moving
- Repairs bring more people and equipment near moving equipment

Repairs bring more people and tools near moving equipment. Any change from the routine increases risk. Simple actions – like holding trucks in place while workers finish setting up equipment – help save lives and do not reduce overall productivity. Such precautions ensure everyone is out of the way and focused when equipment begins to move. Minimize movement of vehicles when workers on foot are performing change-over, repair, or other tasks. Do not sacrifice safety during such times.

2. Safe Practices for Drivers and Operators

The main categories of safe practices are

- Back up safely
- Know your surroundings
- Designate a spotter
- Walk around vehicle before backing
- Use designated vehicle pathways

This is an overview of the four main categories of safe practices for drivers and operators. Each category is presented in more detail below.

Back Up Safely

Backing is one of the most dangerous situations in which workers on foot are vulnerable, especially if the equipment is a large dump truck. There are several key principles to safe backing in work zones

- Backing should be controlled, used only when necessary and under specified conditions
- Organize the work area to minimize backing
- Clear communication between the operator and workers on foot before backing begins
- Operators and workers on foot should all understand the blind areas around the equipment on site
- Avoid backing up unless it is absolutely unavoidable
- Walk around the vehicle to check for hazards – if there is no spotter
- Be aware of blind areas

Know Your Surroundings

The operator needs to be fully aware of his or her surroundings. This includes objects at ground level, other vehicles, and workers on foot. An important practice is to communicate site conditions and safety with truck drivers before they enter the work space, and then continuously during operations. Keep them informed about the site safety plan and changing conditions.

Designate a Spotter

Spotters are recommended by ANSI and other agencies. Spotters are required by some states, including Virginia and Washington State, when camera/radar systems not used.

A spotter can be designated from the on-site crew and should be trained in proper signaling and self-positioning. If multiple people are near the spotter, or more than one person tries to give the driver directions, it will be confusing.

Designate ONE spotter and have other workers remain clear of him or her. A good practice is to conduct a morning risk assessment for the day's operations to determine if a spotter should be designated.

Trained spotters are essential in work areas where there are numerous workers on foot nearby, many vehicles operating in a confined area, or obstacles that may not be visible to the driver.

A spotter can also be in danger from vehicles – who is spotting the spotter? If visual contact is lost, the driver/operator should stop immediately until the spotter is located.

Nearby workers must know the spotter's responsibilities and not approach equipment without permission. Spotters should be trained in safe procedures, including continuous communication and remaining visible to the operator at all time.

Walk Around Vehicle Before Backing

Before moving vehicles or equipment, the operator should walk around it to ensure no person or obstacle is in the blind areas. The alternative plan is for the operator to use a spotter.

Use Vehicle Pathways

A key element of the ITCP is to develop a route for vehicles entering, exiting, and traveling through the work space. The route may be marked with temporary traffic control devices (TTCDs). The plan must be communicated.

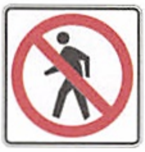
The ITCP should plot where pedestrians will normally be located, the types of equipment in the work area, and the path for each type of equipment. The paths for truck and construction vehicle movement should be planned in conformance with the principles of safe construction traffic control.

Vehicle pathways are most critical when deliveries are made by a variety of subcontractors and independent drivers not familiar with the site and procedures. Some contractors name/designate access and egress locations to inform drivers where they should go. For example: A Area, B Area, C Area, etc.

Long backing maneuvers for dump trucks should be avoided, and points of access and egress for trucks moving within the work space should be controlled. TTCDs may be used inside the work space to separate areas designated for workers and routes for construction vehicles and equipment.

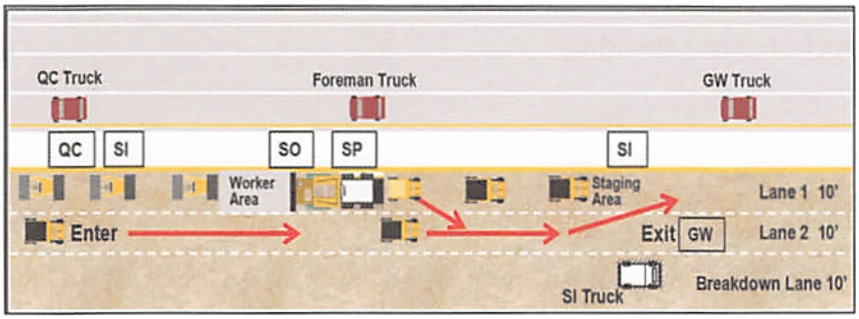
When creating vehicle pathways, the primary concerns are ensuring that drivers/operators know where they should and should not go and ensuring workers know the areas to avoid. Route planning occurs *before* vehicles arrive on site. Workers on foot should be located as far as possible from vehicle paths. Parking, toilet, and break areas should be staged away from the principal conflict points involved with the paving rollers, dump trucks, and other equipment.

3. How to Set Up Worker-Free and Equipment-Free Zones



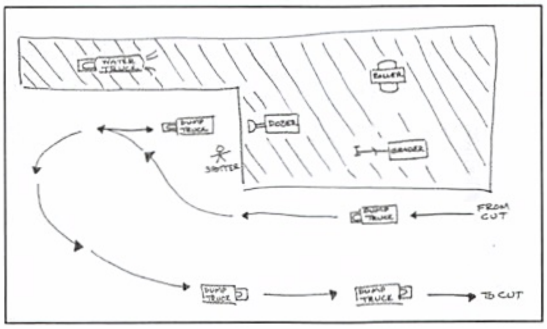
Worker-free zones are locations that workers on foot must avoid. These include

- Blind areas around equipment
- Equipment travel lanes and queue areas in paving trains
- Moving equipment, including swing radius, pinch points, and moving parts
- Other hazardous areas, such as near power lines



The key principles for creating vehicle pathways are 1) Planning routes in advance, 2) Communicating routes to site personnel and delivery drivers, 3) Delineating worker-free zones and equipment-free zones so all workers and operators know where they are expected to be.

The computer drawing on page 1 is a sample plan for delivering asphalt to a paving operation. It shows how delivery trucks enter the work space, queue for delivery, back up to a paver, empty the load, and then exit. While this is an example of a detailed *model plan*, this can be accomplished with hand-drawn diagrams. More detailed information on creating ITCPs appears in Unit 6.



ITCPs can be detailed, such as the computer-generated drawing, or as uncomplicated as the hand drawing. The only purpose is to communicate equipment paths and worker zones. In this dirt spread operation, the simple drawing demonstrates how dump truck access points are limited. Backing operations are controlled by the spotter and dirt spreaders.

In some instances, workers must enter the worker free zones to perform their duties. These might include performing quality control and density measurement for asphalt because the worker free zone would include the roller area. In this instance, there must be clear and constant communication between the QA (quality assurance) technician and the roller operators as to where the QA tech will stand during roller passes.

Delivery vehicles should be made aware of the procedures that will be employed when workers approach them to receive information or provide instruction. This notification will alert drivers where to anticipate seeing workers on foot.

4. How to Control Parking and Staging of Vehicles, Vehicles Entering the Work Space, and Truck Queues

Anticipate the locations and routes workers may take

- Set up safe location for workers to park vehicles and access the work space
- Mark crossing points where workers on foot can cross over construction vehicle paths and – only when absolutely necessary – open traffic lanes (In most situations, this should be avoided.)
- Ensure rest areas, toilets, water coolers, etc., are located where workers can safely access them without crossing vehicle paths

AUTHORIZED VEHICLES ONLY

By addressing typical worker behaviors and needs, an ITCP can be used to anticipate the locations and routes workers may take and make safe accommodations, routes, or detours to help them safely navigate the work space.

The locations where vehicles are staged and parked have a direct impact on safety as workers on foot move around the work area.

For vehicles entering the work space, plan the locations and procedures for assigned workers to approach the vehicles (for example, to take the load tickets and communicate delivery locations and procedures).

Delivery vehicles should be made aware of the procedures that will be employed when workers approach them to receive information or provide instruction. This will alert drivers where to anticipate seeing workers on foot.

In most work zone situations, there are technological solutions that can alert drivers and operators to the presence of workers on foot. These include alarms, cameras, radar, sonar, and tag systems.

Each technology has unique deployment challenges, ranging from dirty lenses to high cost. As this equipment grows in use and experience, many of these challenges are being overcome.

For in-depth information on technology solutions, see Unit 7.

MODULE 3
Access and Egress

At the end of this unit, you will know

1. **Why control of access and egress is so important**
2. **Challenges in access and egress**
3. **How the ITCP addresses each challenge**
4. **How FHWA Subpart K impacts access and egress**

Access and egress are a critical aspect of a well-planned ITCP.

1. Why Is Access and Egress Control Important?

The establishment and maintenance of safe access and egress points are key determinants of project safety. In order for roadway construction jobs to maintain safe operations, there must be procedures to allow for safe and efficient passage of work vehicles into and out of the work space and for motorists to travel through the work zone.

CONSTRUCTION
VEHICLES
ONLY

Effectively addressing safe access and egress at the project level requires planning during the project development phase and implementing traffic control plans throughout the entire project.

Hazards compound when a roadway carries high traffic volumes and/or operates at high traffic speeds.

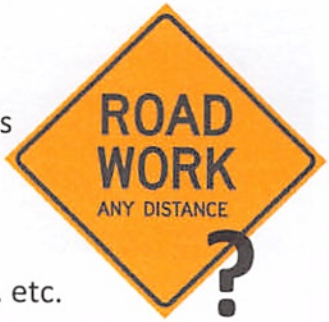
Conditions often include motorists following construction vehicles into the work space, acceleration and deceleration of construction vehicles entering/exiting open traffic lanes, and the proximity of workers on foot to access and egress locations.

2. Challenges in Access and Egress

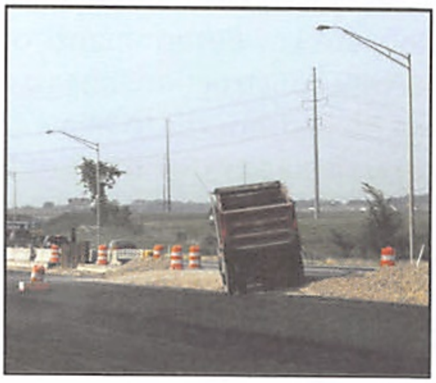
The primary challenge is safely and efficiently getting materials and equipment into and/or out of the work zone. Of necessity, this involves acceleration and deceleration of the large, heavy trucks and equipment hauling the materials. These construction vehicles must leave and enter the traffic space, where motorists often drive at high speeds, and transition to the work space, filled with slow moving equipment and workers on foot.

Attendant challenges include

- Acceleration / deceleration lanes
  - Short or non-existent
- Signage for merge / exit points
  - Signs giving vague information
  - Messages left up 24/7
- Flagging operations
  - Best with low traffic, moderate trucks
  - Intermittent flagging for low trucks
  - Rules are forgotten
- Night work
  - Poor sight distance, impaired drivers, etc.



Note the entrance to the work area at right is provided via an earthen ramp between the work area and travel lanes. The truck must enter from and exit into the high speed left travel lane without adequate acceleration or deceleration space. This is not a good plan.

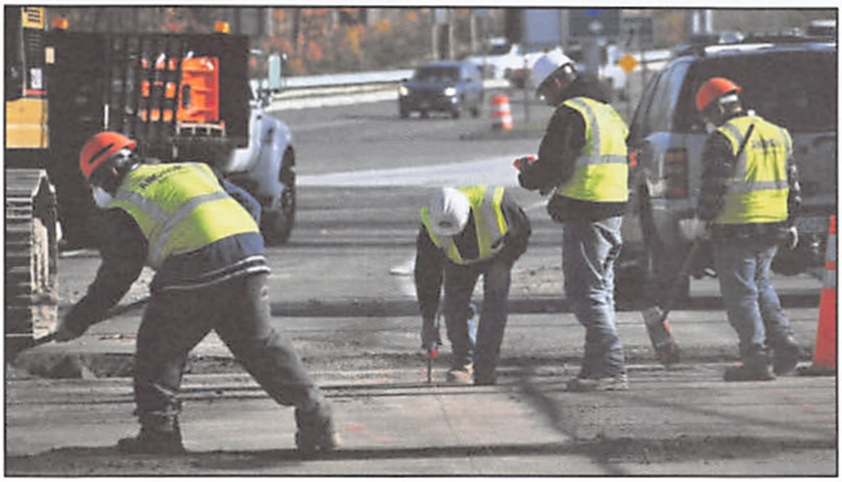


3. How the ITCP Addresses Each Challenge

The ITCP should coordinate activities so all involved know what the others are doing and each stays out of the path of the other. The work area can be complex with delivery trucks entering and exiting the work space near workers on foot and other operating/ moving equipment.

In the example at bottom left, the employee vehicle and worker on foot would be in direct path of a vehicle entering the work area. A risk analysis would identify the location of the parked vehicle as a hazard. A different parking site should be identified.

Employers should train employees on where to park and where not to park onsite. Employers should also train on particularly hazardous areas like access and egress points.

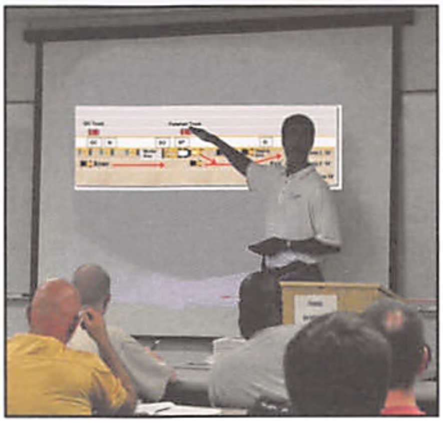


Access and egress challenges can be addressed by an ITCP in the following ways

- Isolating workers on foot from trucks and equipment
- Limiting/controlling vehicle access points
- Coordinating truck and equipment movements
- Providing guidance to workers on foot, truck drivers, and equipment operators
- Designating locations for parked vehicles and equipment
- Raising awareness about vehicle intrusions with workers and operators/drivers

Entering and exiting the work space can require rapid acceleration and deceleration. The dynamics of the situation may be impacted by whether the truck in loaded or empty. Taking the load into consideration, ITCP design can make the work environment safer.

Activities that occur under the direction of construction contractors include maintaining a clear/open area around access/egress points where equipment or vehicles should not be parked. Contractors are also responsible for educating onsite employees about areas near access/egress points that are prone to heavy truck traffic.



When truck queues form near exit and entry points they create hazards for other vehicles attempting to enter (with little deceleration space) and exit (with little acceleration space). If queues threaten to block these spots, queues should be redirected, or different access and egress spots should be identified for drivers to use.

Speed differential between traffic lanes and the work space is a challenge for truck drivers, and can create significant hazards for workers and motorists.

In addition to creating special ramps or other lanes, all access and egress areas should be kept clear of debris, signage, parked vehicles, etc.

ROAD CLOSED

Roadway construction involves moving operations. As the work progresses, so moves the work site. With continual changing conditions, access and egress points may change. Crew, operators, inspectors, subcontractors, and others may not be up-to-date on access/egress locations as work progresses.

LEFT LANE
HOV - 2 ONLY
6:30 - 9 AM
MON - FRI
KEEP RIGHT

The best way to keep all members of the construction team up-to-date is to hold pre-shift meetings where the day's activities are discussed and those involved can receive updates. Access and egress points require gaps in barriers and traffic delineation. These gaps can allow traffic to enter the work space unimpeded and therefore create increased exposures to workers. Motorists may breach barriers and strike workers near access and egress points.

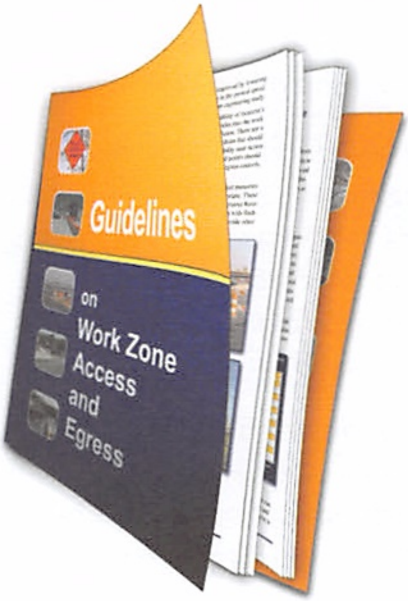
Temporary traffic control devices (TTCDs), particularly end treatments, should be checked regularly to ensure they are in good operating condition. Part of the ITCP is to evaluate end treatments when access/egress points are opened and closed.

4. FHWA Subpart K Impacts Access and Egress

Federal Highway Administration Traffic Control Devices Rule – 23 CFR 630 (Subpart K) requires agencies and contractors to consider road user and worker safety by addressing

- Use of positive protection devices to prevent intrusions
- Exposure control measures
- Other traffic control measures to minimize crashes
- Safe entry/exit of work vehicles/equipment from travel lanes

The guidance document *Guidelines on Work Zones Access and Egress* outlines the importance of work zone access and egress considerations, provides planning and design guidance pertaining to work zone access and egress, discusses methods of maintaining access and egress points during construction, and provides innovative examples of how safe work zone access and egress points can be accomplished. Another guidance document Guidelines on Implementing 23 CFR 630 Subpart K provides a thorough introduction to Subpart K. Both documents can be downloaded at the link below.



http://www.workzonesafety.org/research/record/10882

MODULE 4

ITCPs and Productivity

At the end of this unit, you will know

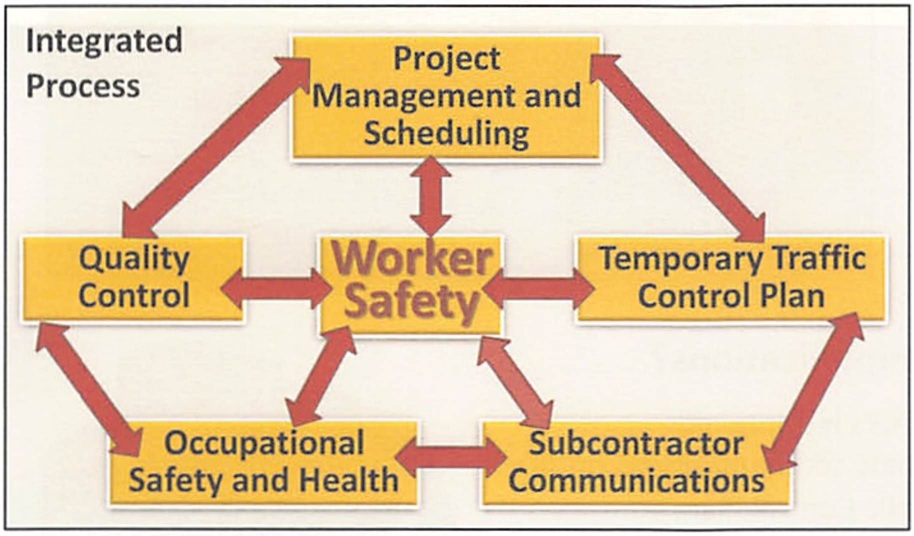
1. **How ITCPs improve productivity**
2. **How ITCPs improve communications**
3. **Management elements addressed in the ITCP**

The well-planned ITCP improves productivity through greater efficiency.

1. How Do ITCPs Improve Productivity?

Remember, the key concept of Internal Traffic Control is PLANNING for worker safety. ITCPs improve both safety and productivity if the plans are well thought out.

ITCPs integrate other aspects of planning to coordinate onsite activities so they run in a safe, smooth, efficient manner. Increased productivity is a byproduct of ITCPs as the process of setting up an ITCP translates into smoother operations unrealted to Internal Traffic Control. But, to improve productivity, the ITCP must be well conceived.


Integrated Process
Project Management and Scheduling
Quality Control
Worker Safety
Temporary Traffic Control Plan
Occupational Safety and Health
Subcontractor Communications

When considered during the planning and design phases, ITC planning integrates easily into other planning processes so that it does not require significantly more time or resources to implement. Anticipating ITCP and worker safety needs will improve delivery schedules and processes, minimize disruptions, improve safety, and create more efficiency. ITCP is an integrated process, as shown in the diagram above.

Link-Belt
DANGER
OVERHEAD POWERLINES BOOM DOWN

Well-executed ITCPs will control overhead and buried cable hazards – such as cranes operating near overhead power lines or earth moving equipment near buried utilities. The ITCP alerts workers to the locations of all these hazards.

Which of these two scenarios is more productive and efficient?

ITCP planning will ensure operators do not operate equipment around such hazards unless they are authorized and trained to do so. These plans can also alert workers to these and other hazards caused by utilities, catch basins, excavations, etc.

ITCP planning can improve productivity through reduced repositioning. ITCPs work in tandem with project scheduling processes. In addition to assigning dates to project activities, project scheduling is intended to match the resources of equipment, materials, and labor with work tasks over time.

Good scheduling can

- eliminate problems due to production bottlenecks,
- facilitate timely procurement of necessary materials, and
- ensure the completion of a project as soon as possible.

Inasmuch as ITCPs require timely communication with delivery vehicles, ITCP coordination and project scheduling fit together easily.

2. How Do ITCPs Improve Communications?

One of the greatest contributions of ITCPs is improved communications. How you plan to handle communications on site is an important part of an Internal Traffic Control Plan.

Above left is an asphalt truck arriving at the paving site. In developing an ITCP, consider how you will communicate with drivers *before* they arrive. Planning this communication will translate into overall better communication with all subcontractors on other onsite scheduling and activities.

One solution is to install a CB radio on the paver or other onsite equipment. Another is to identify a lead driver who will communicate with others in the fleet.

NOTES

The process required for setting up an ITCP communications plan can translate into better communications and productivity for the overall project. Relevant ITCP elements include

- creating notifications for the chain of command,
- creating lists of key contact persons and emergency responders, and
- organizing daily communications with site personnel.

Such elements create a process for dealing with day-to-day project management issues.

The ITCP communications plan requires specific items that may not be considered for other project communications.

The ITCP will anticipate a means to communicate with workers, operators, truck drivers, etc., about routine changes to the plan.

The ITCP communications plan will cover worker-to-operator/driver communications when internal traffic and worker paths cross.

This includes hand signals, radio communications, lighting, etc. A very simple communications tool is an air horn, which can be sounded if there is a problem. Workers must be trained to stop all operations if the air horn sounds. The ITCP will cover a process for communicating with the truck boss and truck drivers daily to explain the routes and precautions they should take.

3. Management Elements Addressed in the ITCP

The following management elements are addressed in the ITCP

- Chain of command
  - Onsite equipment and personnel
  - Contact information – including onsite contractors
  - Contract agency
  - Emergency response services
  - Location, time table, and scope of the project
  - Assignment of responsibilities
- Operations communication plan should include
  - Communications regarding changes to the ITCP
  - Means for workers on foot to talk with operators, truck drivers, and others coordinating access and egress of vehicles and the movement of heavy equipment within the work space
  - Means for equipment operators to communicate with each other and with key site personnel
  - Plan for orienting independent truck drivers and subcontractors to the work space and the ITCP

MODULE 5

Roles and Responsibilities

At the end of this unit, you will know

1. **Who is responsible for the ITCP**
2. **ITCP roles of all those on the site**
3. **Responsibilities of site visitors**

When everyone knows and performs his/her role, the ITCP functions most effectively .

1. Who Is Responsible for ITCPs?

Responsibility for developing, maintaining, and changing the ITCP rests with those responsible for site safety — primarily the foremen in collaboration with the site superintendent.

For the ITCP to be successfully implemented, many people need to be included in executing the plan. If possible, key people should meet together to discuss the various phases of the ITCP process. ITCPs will be developed in phases:

- Planning
- Developing the Construction Work Plan
- Site Operations

Though most ITCP work occurs in the Site Operations phase, some work will be necessary well before the first site worker arrives.

As conditions change and/or as operations change, so must the ITCP. As the project changes, responsibility for administering the ITCP may shift depending on who is on site when conditions and/or operations change.

A good ITCP program may involve a number of key people

- Safety professional
- Inspectors/quality control
- Superintendent/project manager
- Supervisor and lead person
- Workers on foot
- Truck drivers

Others involved in the ITCP include

- Equipment operators
- Spotters
- Site 'visitors' – surveyors, OSHA, senior management, etc.

2. Roles of All Those on the Site

Following is a discussion of the role of each of those on site.

Safety Professional

PRIMARY ROLE IN ITCP: Training and Oversight

- Ensure that site-specific ITCP is created
- Train onsite personnel in ITCP concepts
- Ensure all construction supervisors are familiar with the plan

The Safety Professional should meet the OSHA requirements of a 'competent person.' This means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization from the employer to take prompt corrective measures to eliminate them.

The safety professional will support the job supervisor (or other designated competent person) throughout the project's duration and should have a role in the development and monitoring of the ITCP. Other onsite personnel, such as lead persons and foremen, are those most likely to administer directly and modify the ITCP as site conditions change.

Inspectors/Quality Control

PRIMARY ROLE IN ITCP: Liaison

- Consider ITCP needs during site operations phase
- Assist and advise in plan execution
- Communicate with road owner the importance of ITCP implementation

The primary role of the DOT Inspector and/or Quality Control Engineer is that of Liaison with the owner/agency.

In some jurisdictions, the inspector is required to be on site at all times. In other states, the inspector makes periodic visits.

In most situations, QC and inspectors are regularly on site and are often there every day for a good portion of the day as they take the load tickets, measure asphalt laid, or conduct QC.

Superintendent/Project Manager

PRIMARY ROLE IN ITCP: Oversight

- Oversee ITCP implementation
- Ensure subcontractor coordination and 'buy-in'
- Assign personnel to carry out the plan

The project superintendent and/or project manager is a key person in ensuring an ITCP is implemented properly on the site. While the superintendent/manager may assign one or more foremen to directly implement the plan, the superintendent/manager controls the various factors that must be coordinated to ensure cooperation in ITCP implementation. To properly implement the plan, workers, operators, dump truck drivers, inspectors – virtually all site visitors must be apprised of the plan and made aware of its basic operation. Such coordination and implementation is greatly facilitated with support of the person in charge of site operations and the project schedule.

Supervisor and Lead Person

PRIMARY ROLE IN ITCP: Implementation

- Plan and implement the ITCP on site
- Responsible for coordination among personnel and subcontractors at the construction site
- Ensure changes are made to ITCP as site conditions change

With direct responsibility for onsite operations, compliance with the project schedule and coordinating personnel, the supervisor or lead person will play the most important role in developing and executing the ITCP. He/she should be involved in initial planning activities. The supervisor/lead person will implement the plan by directing onsite operations and ensuring workers on foot, operators, dump truck drivers and other onsite workers are apprised of the ITCP and know where and how they should carry out their duties in compliance with the plan. The lead person/ foreman will have responsibility for ensuring the plan is updated as work progress and site conditions change. He/she is also responsible for general workplace safety.

Workers on Foot

PRIMARY ROLE IN ITCP: Understand, Comply, Correct Deficiencies

- Learn the elements of ITCPs and how to comply
- Understand the hazards of working around equipment
- Take responsibility for personal safety and apply safety training lessons

The ITCP concept was conceived and designed to protect workers on foot from being struck by dump trucks and other construction equipment while working.

Workers on foot must be trained and disciplined to understand the basic elements of an ITCP – both in terms of how it protects them and the specifics of what has been planned for the site where they are assigned to work.

For workers on foot to be able to comply with ITCP protections, they must

1) understand the Internal Traffic Control Plan (ITCP),
2) be supported in their efforts to comply,
3) be provided with site conditions that allow for their protection (including access to restrooms, coolers, parking, etc.).

In other words, workers on foot need to understand the hazards of working around equipment including blind areas, stopping speeds, and communications with operators.

Truck Boss

PRIMARY ROLE IN ITCP: Communicate with Other Drivers

- Share ITCP instruction on where drivers should operate
- Assist in communicating safe site procedures with all truck drivers

The truck boss needs to be informed about the daily plan as well as the initial planning of the site. He/she will provide vital information affecting operation safety that should be considered in the planning process.

In the training process, those involved need to recognize the primary purpose of the truck drivers: to deliver material.

Drivers want to do this as efficiently as possible so they can return with another load. Their focus is aligned with the ticket taker on site, and the dump man once the truck is in the queue.

Truck Drivers

PRIMARY ROLE IN ITCP:
Keep a Safe Distance from Workers on Foot

- Receive ITCP instructions on where they should operate
- Receive navigation assistance (spotters) when appropriate
- Never operate into a blind area without checking for pedestrians

Dump trucks present the greatest risk to workers on foot. U.S. Bureau of Labor Statistics data shows that dump trucks are responsible for more than 25% of all runover or backover deaths in this industry. This is primarily because dump trucks have large blind areas in which the driver cannot see. Truck drivers are 'visitors' to the site. Truck drivers are in constant movement on site as they enter, back up, dump, and exit the work area.

Truck drivers must be informed of the ITCP and know where they should and should not go. Drivers should be provided with ITCP instructions and receive navigation assistance (spotters) in the work space, when appropriate.

Equipment Operators

PRIMARY ROLE IN ITCP:
Know Locations of Workers on Foot

- Do not move until the blind area is checked or a spotter is assigned
- Know blind area for equipment you are operating
- Stay out of areas designated for workers on foot
- Do a 360° 'walk-around' before moving equipment

An equipment operator can easily strike workers on foot because he/she is unaware they are laboring near the equipment. Construction equipment has blind areas where the operator operator cannot see workers or objects. While operators may be more familiar with site conditions than truck delivery drivers, they too must understand ITCP procedures. These include using spotters or performing visual checks when entering blind areas, not allowing workers to approach without a clear signal to do so, and staying outside of areas designated for workers on foot.

Spotters

PRIMARY ROLE IN ITCP: Safe Backing

- Ensure operator knows where you are and will be located – make eye contact
- Ensure workers know your responsibilities and wait for permission to enter the area
- Take training in safe spotting procedures and know signals
- Stay in continuous communication with operator and remain visible at all times

Spotters are recommended by ANSI and other organizations for backing operations, particularly those with large blind areas. Spotters should be trained in standard signaling procedures. Some states (VA and WA) require a spotter when camera/radar systems are not used. Remember, spotters can also be in danger from vehicles – who is spotting the spotter? Spotters can help when you must work with your back to equipment or traffic. If a driver/operator loses visual contact with the spotter, he/she must stop immediately until the spotter is located.

Site Visitors

PRIMARY ROLE IN ITCP: Get Informed

- Check in with site supervisor when you arrive
- Ascertain proper location to park your vehicle
- Do not enter blind areas
- Stay in areas designated for workers on foot

Visitors may be safety personnel, superintendents, company owners, and other contractors. The occasional visitor is likely to be least familiar with current site conditions, designated areas for parking, locations where workers on foot are laboring, etc. Early communication with visitors is critical to let them know an ITCP is in effect. Responsibility for communicating this information should reside primarily with the project manager as he/she is most likely to know who will visit and when.

Visitors should park at an off-site staging area and receive an ITCP briefing. If they enter the work space, there should be a designated entrance point and pathway for their duties at the site. Visitors must know where to park once they enter the worksite. The choice of parking location may impede the production process, cause unnecessary hazards to workers on foot or equipment operators, or cause hazards for drivers on the roadway. Procedures for handling and storing construction material deliveries at the site should also be discussed with visitors.

When visitors arrive on site, the foreman or lead person should immediately approach them to make sure they understand ITCP rules and do not place themselves or a vehicle in a location that will impede proper operation of the plan.

MODULE 6

Developing an ITCP

At the end of this unit, you will know

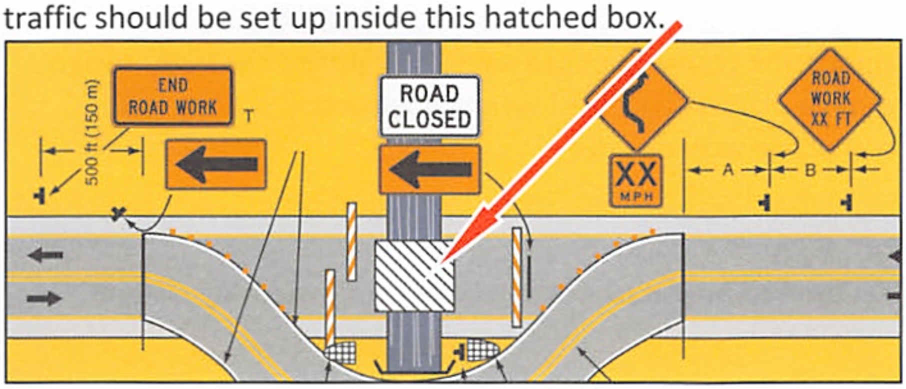
1. **When the ITCP should be developed**
2. **What ITCP aspects are developed during each project phase**
3. **How to create the ITCP**
4. **How to use TCDs in the ITCP**
5. **How to enforce an ITCP**

The ITCP affects everyone in the work zone.

1. Review of the Internal Traffic Control Plan (ITCP)

The internal traffic control plan (ITCP) is a process used by project managers and others with production responsibility for roadway construction projects. The ITCP is used to coordinate and control the flow of construction vehicles, equipment, and workers operating in close proximity within the work space to ensure the safety of workers.

Internal Traffic Control coordinates construction traffic inside the ACTIVITY AREA of a temporary traffic control zone (TTCP). The ACTIVITY AREA is where construction work takes place. It appears as a hatched box on temporary traffic control plans and 'typical applications' in the Federal Highway Administration *Manual on Uniform Traffic Control Devices (MUTCD)*. Internal Traffic Control Plans fill in all the details on how construction traffic should be set up inside this hatched box.



2. When to Develop an ITCP

Different aspects of the ITCP will be identified and developed during various construction phases of a project. Depending on the phase, different people will be involved in process.

The ITCP should be considered from the very beginning of a project. Some important elements – such as the size of the work space – will be dictated by the amount of right-of-way, number of lane closures, and other decisions.

To achieve proper separation between workers on foot and mobile equipment, adequate space is necessary. If such considerations are not anticipated from the beginning, it will be more difficult to organize a complete ITCP.

- The first phase (**design**) is when the project is first bid and won. A general plan should be created at this point.
- The second phase (**planning**) takes place when projects are being laid out, the original plan is flushed out into phases, and plans are developed for those phases.
- The third phase (**pre-construction**) is the time period before the work begins. In that phase any additional modifications should be added to that plan like other activities on site or changes to internal traffic in the plan.
- The final phase (**construction**) begins the day of construction; any final changes need to be communicated to everyone on site that day.

3. Bidding and Planning Stages

State and local agencies have significant influence on decisions made during early planning of a project that impact options available to the contractor when developing an ITCP. Planners can ensure the project has access and egress points that are not encumbered by roadway geometry or structures such as bridges. Consideration may be allowed for

- Right of way
- Temporary traffic control
- Risk assessment
- Equipment selection
- Selection of contractor and subcontractors based on past safety performance

Forethought to ITCP needs especially impacts the amount of right-of-way obtained for acceleration/deceleration lanes, access/egress points, and parking and staging of vehicles. OSHA and other organizations encourage consideration during the planning phase with **'Prevention Through Design'**. It is NEVER too late to set up an ITCP. Even if a plan is conceived when construction is underway, many ITCP concepts can be employed to improve worker safety.

4. Contractor Planning Phase

The Contractor Planning Phase is an ideal time to negotiate responsibility for executing certain elements of the ITCP.

Duties can be allocated to the roadway owner, project engineer, superintendent, foremen and other personnel. Risk can be properly allocated and processes can be assigned. Assigned duties can include

- Safety meeting participation
- How and if law enforcement will be used
- Location of access and egress points
- Amount of lane encroachments

5. Construction Phase

The ITCP is implemented during the construction phase. It should be part of the project safety plan. The site supervisor/foreman should oversee implementation and will likely develop the site plan. Foremen, supervisors, lead persons, and others are crucial for implementation and should be taught the principles of safe construction traffic control. They will be in charge of daily set up and monitoring of the ITCP.

Responsibilities for key personnel are assigned and any remaining training is conducted during this phase.

- Safety professional – assists in developing the ITCP and performs audits
- Site supervisor – assists in developing the ITCP
- Fore/lead person – develops and implements the ITCP

Onsite workers are provided training in both overall ITCP concepts and specific implementation elements at their assigned work area.

To function properly, the ITCP must be reviewed and modified each day before the beginning of each shift so employees can receive instruction on how it will be implemented that day.

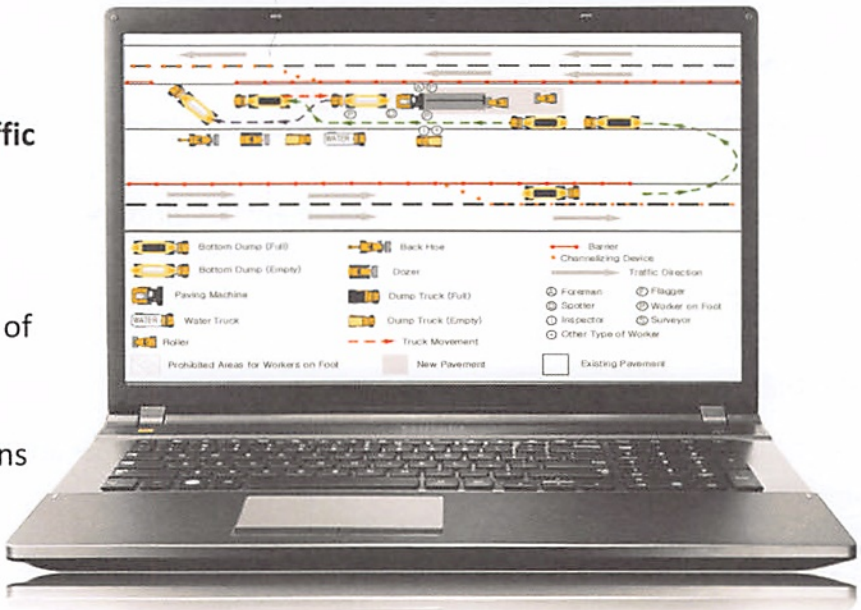
In addition, ITCPs may be modified more frequently as conditions change throughout the day.

During the construction phase, the following should also be accomplished

- Subcontractor selection, buy-in, communications (e.g. trucking, excavation, etc.)
- Owner/agency coordination and communications
- Selection of equipment with smaller blinds and adding cameras and/or proximity warning devices

A good communications plan is essential during the construction phase. A process must be engaged to coordinate the ITCP and site conditions among all those who will enter the work space. At this point, subcontractors will need to be engaged as their operations will be impacted by the creation and implementation of the ITCP. When seeking to identify all those impacted by the ITCP, it is imperative that all subcontractors and their operations are considered and educated about the program. A failure by one subcontractor can impact the safety and production of the entire site.

6. ITCP Elements



The main elements of the Internal Traffic Control Plan are

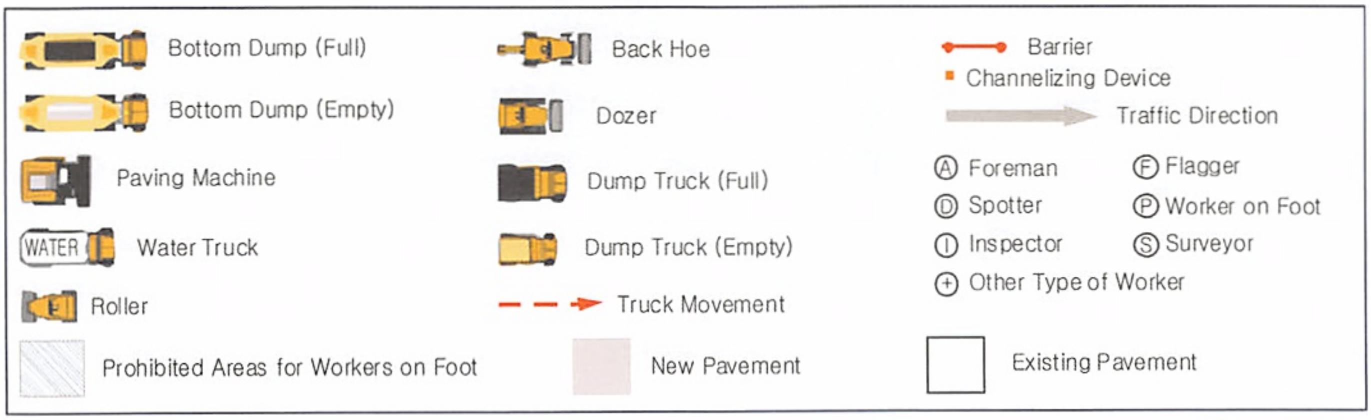
- ITCP diagrams
- ITCP notes

The ITCP notes are critical to execution of the plan. The notes should address

- Injury reduction measures
- Site specific conditions and provisions
- Duties
- Equipment and personnel lists
- Notes on safety points

The ITCP notes should be very specific about elements such as vehicle speed limits in the work space near workers, how to identify and locate employees taking tickets, and requirements for drivers to keep their windows down (when appropriate) so they can hear site sounds and warnings. These notes become site audit tools to assist supervisors in auditing the success of their safety program.

The key (legend) for the ITCP diagrams can use symbols based on the Federal Highway Administration *Manual on Uniform Traffic Control Devices (MUTCD)*.



Bottom Dump (Full)
Bottom Dump (Empty)
Paving Machine
WATER
Water Truck
Roller
Prohibited Areas for Workers on Foot
Back Hoe
Dozer
Dump Truck (Full)
Dump Truck (Empty)
Truck Movement
New Pavement
Barrier
Channelizing Device
Traffic Direction
Ⓐ Foreman
Ⓓ Spotter
Ⓘ Inspector
⊕ Other Type of Worker
Ⓕ Flagger
Ⓟ Worker on Foot
Ⓢ Surveyor
Existing Pavement

The legend explains the symbols used on the ITCP diagram. However, additional details on classes of personnel and vehicle types are needed in developing an ITCP. The example key shown is from an ITCP for a paving operation. The key may also be hand drawn. The important thing is that you provide a key or legend so someone reading the diagram understands the symbols you have used.

7. Creating the Plan

NOTES

Creating the plan involves these steps

- Identify the project scope and the plan scope – as these vary from job to job
- Identify the operation to take place (e.g., paving, trenching, earthmoving, etc.)
- Identify the individuals who will be involved
- Review the site plan
- Implement a communications plan
- Identify suboperations (e.g., asphalt sampling, watering rollers, loading/off loading equipment, equipment maintenance)

The first step includes recognizing the scope of the project, the operation, and each of the tasks that will be performed. Based on these planned operations, the contractor will identify personnel who will be involved.

The next step is to review the site plan. Identify what will take place and where.

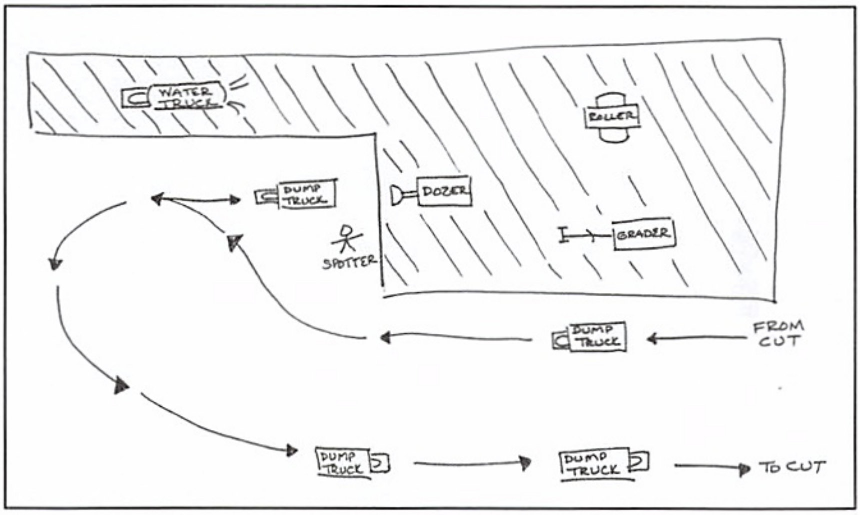
- Is there space for workers to park cars and safely access the work area?
- Where will restrooms, water coolers, and break areas be located?
- What equipment will be on sight?
- How many workers are needed to operate the equipment?
- What work will be done by workers on foot?
- Can they be physically separated from equipment operating areas and vehicle travel paths?
- How is the TTCP organized?
- Are workers sufficiently protected by the TTCP?

By asking and answering these questions, you will begin to formulate your ITCP.

Next, you will need to assess how your work will proceed once operations begin. How quickly will the operation move? For example, earth moving and site preparation work may remain in the same location for weeks, even months. Paving operations, particularly resurfacing, will move down the road more quickly. How often will access and egress points need to be relocated? How frequently will asphalt, aggregate or other materials be delivered to or removed from the site? By addressing these questions you will begin to understand how frequently your ITCP will need to change or be updated.

The final phase in creating the ITCP is implementing the communications plan – including training.

- Who will develop the ITCP?
- Who will review/approve it?
- Who will update the plan and stay in constant communication with site supervisors, foremen, subcontractors, workers, operators, etc.?



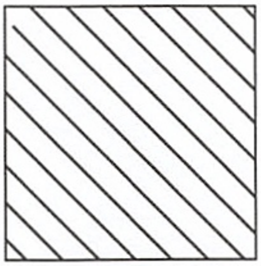
The most challenging part of ITCP implementation will be communicating with drivers of delivery trucks (dump trucks) and other site visitors who are not direct employees of the contractor. These communications can be difficult and require constant monitoring.

Who will evaluate communication and ensure that it is functioning properly?

When creating your ITCP, take into consideration activities that support the main operation. For example, if the operation is laying asphalt, consider how rollers will be watered, asphalt will be sampled, etc. The key element to consider is the coordination of the movements of workers and equipment during these support operations.

5. A Site Specific ITCP

Site specific ITCPs should be developed for different phases of the project as the site conditions change. ITCPs are *living* documents that must be updated to reflect current conditions.



Worker-Free Zone

Once you have the basic work area drawn out, plot the following

- Locations where workers on foot and construction equipment will operate
- Locations of equipment and vehicles
- Paths of vehicles approaching and leaving the operation
- Locations of utilities, storage areas, other obstacles or hazards, if any

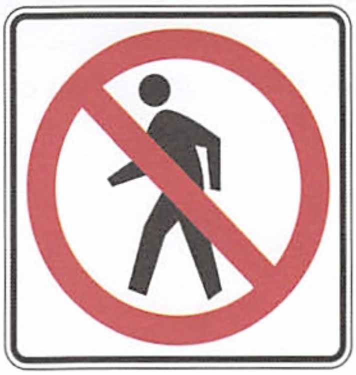
Show areas ground workers are to avoid (worker-free-zones) and the path workers will take to complete their duties, check on materials, etc. Identify backing zones, access/ egress points, work activity sites, worker paths to rest areas, and site visitors' parking

Finally, plot the location of overhead and underground utilities, storage and staging areas, and any other known obstacle or hazard. This process creates the ITCP diagram, which can be used to show workers, equipment operators, dump truck drivers, and others how workers on foot and equipment will move about the site.

Remember, the main goal of the ITCP – to the extent possible – is to remove workers from the risk of being struck by construction vehicles and equipment. To do this, lay out on the ITCP diagram the equipment paths and the worker-free zones.

After the ITCP diagram is drawn, create plan notes to explain important aspects of the diagram, such as worker-free zones and any other site-specific safety points – such as onsite speed limits, spotting instructions for overhead power lines, or instructions for the ticket taker to stay on the driver's side of dump trucks. Explain in the notes if special signage will be used to direct construction vehicles inside the work space.

CAUTION
LOOK UP
POWER LINES
OVERHEAD



6. Can TTCDs Be Used in an ITCP?

There are no specific ITCP signs. Any type of signage that displays direction to workers on foot or vehicles can be used. The intended signage should be in place before a new path, walkway, detour, or temporary route is opened. Signs required by road conditions or restrictions should be removed when those conditions no longer exist. Care must be given to ensure ITCP signs do not confuse passing motorists for whom the signs are not intended. Signs should only be used where justified and should not be seen by passing motorists.

7. Enforcing an ITCP

Enforcing the ITCP should be a team effort. The safety officer, foremen, and supervisors are all responsible for maintaining work zone compliance and should be able to warn workers on foot or vehicle operators of violations of the ITCP.

ITCP notes become site audit tools that will assist supervisors in auditing the success of their safety program. Warnings should be given to workers who stray from assigned positions, vehicle operators in pedestrian worker zones, or truck drivers moving at speeds over the site speed limit.

Discipline should be given for violations. Violations should be treated as violations of other company safety policies.

When access points can be controlled, truck drivers and site visitors should be briefed or given an ITCP map showing how to enter the project site, paths to follow, where to stop for staging, and how the spotter will guide them.

Truck drivers should also be briefed on procedures for leaving the work space and re-entering the traffic stream. A basic set of guidelines and rules should be provided for all truck drivers to follow when onsite.

MODULE 7

Technology Solutions in ITC Planning

At the end of this unit, you will know

1. **Six types of technological solutions available for prevention of runovers and backovers**
    - **Alarms**
    - **Cameras**
    - **Radar**
    - **Sonar**
    - **Tag systems**
    - **GPS**

The role of technology in the ITCP is essentially one of communication.

1. How Does Technology Help?

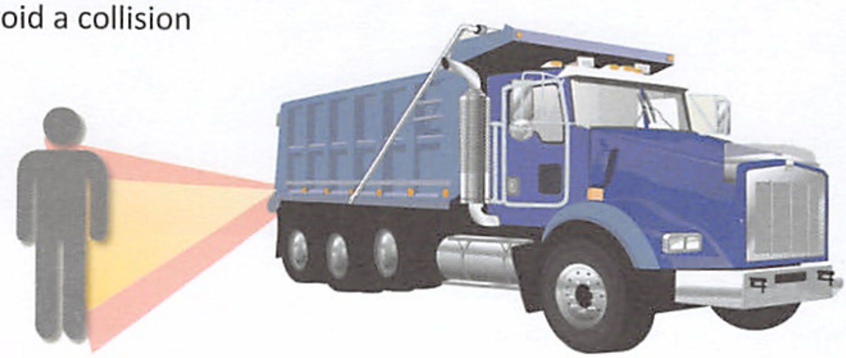
Through alarms, cameras, radar, sonar, tag systems, and other warning technologies, workers and operators have enhanced ability to see each other and be warned when a dangerous situation arises.

Technology will not necessarily 'protect' against a runover or backover incident, but it can provide an additional level of warning and notification in instances where workers on foot, operators, or truck drivers do not follow the ITCP -- or where the ITCP did not fully anticipate or control for a hazardous situation that arises.

2. Terminology

Technology solutions are divided into three main categories. Following is the terminology for each.

- **Proximity Detection:** Detection of personnel, vehicles, other objects near a machine using a sensor technology
- **Proximity Warning (Collision Warning):** Detection of personnel, vehicles, other objects generates alarms
  - Warn only operator
  - Warn operator *and* nearby personnel (two-way)
- **Collision Avoidance**: Processing of sensor information resulting in control signals or actions that alter machine status/movement to avoid a collision
  - Computer control
  - Human control



3. Proximity Detection

There is a variety of proximity detection systems. Some are stand alone while others are network based.

- Independent or stand alone systems
  - Passive sensing of obstacles and personnel
    - + Reflected signals
    - + Warn non-discriminating
  - Cooperative systems mounted on machines, obstacles, personnel communicate with one another
- Network-based systems – Require supporting infrastructure
  - Cooperative, require other infrastructure on the jobsite (GPS or other system)
- Actions: Range from simple alarms to machine control (setting brakes, limiting movement, etc.).

4. Collision Avoidance Approaches

There are three main approaches to collision avoidance.

- Increase situational awareness
  - Visual, audible, tactile alarms
  - Two-way alarming
  - Human is in the loop
- Machine control
  - Processing of sensor information
  - Automatic control of machine functions
- Combination of both approaches

CONSIDERATIONS

The correct approach to avoiding runovers, backovers, or pinning workers depends on the type of equipment and the risks associated with it.

Here are some examples.

- Operator on board
- Operator adjacent to equipment
- Blind areas
- Speed of machine
- Risk to nearby workers or vehicles

5. Camera Systems

There are a growing number of manufacturers of camera/video systems, and pricing is getting more competitive.

Though cameras are a very useful tool in eliminating blind spots, cameras have limitations. It may require multiple cameras for the operator to see all blind areas around his or her equipment.

Also, as construction work is very dirty, camera lenses can get covered with dirt, mud, asphalt etc. This effectively blinds the camera. Finally, even though the camera may capture an image of a worker on foot and display it on the monitor, if the operator is focused on the task, he/she may not look at the monitor.

- Cameras covering blind spots are a proven technology in many industries
- Special considerations for camera use for roadway conditions
  - Appropriate mounting locations (especially on dump trucks)
  - Keeping camera clear of dirt and grime
  - Ensuring drivers/operations look at the monitor

6. Sonar Systems

StructureScanHD
POWER
SONAR

A sonar device uses sonic (sound) waves to detect a person or object that enters its field. When something is detected in the field, the device sounds an alarm. Sonar devices are not as common as cameras, but their use continues to grow.

There are several challenges for sonar systems

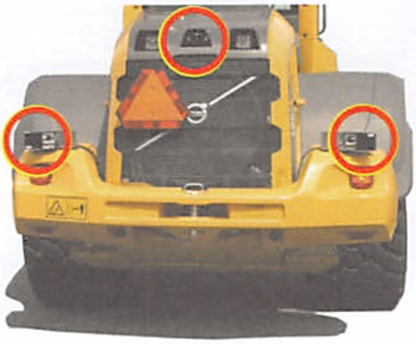
- Sonar cannot discriminate among 'objects'
- Detection triggers an alarm – regardless of the 'object'
- Operator hears 'false alarms' when the detected object is not a hazard
- Sonar detection distance is relatively short
- The detector must be carefully mounted so as not to detect the ground or parts of the equipment

7. Radar Systems

Like sonar, radar waves create a field that will detect an object when it enters the area. The device then generates an alarm to warn the operator. The challenge in working with radar or sonar alone is the system will alert the driver to any 'object' in the monitored area, including cones, piles of dirt, shovels, etc. Because radar and sonar do not discriminate, the operator will receive false alarms. This can cause him/her to be complacent.

Radar-based proximity detection features include

- May be pulsed or continuous wave
- Multiple antennas positioned to monitor blind areas
- Display in the cab provides audible and visual warnings – often with graded alarms
- Typically short range scenarios (25 to 75 feet)



The main challenge with a radar system is that the detector must be carefully mounted so as not to detect the ground or parts of the equipment.

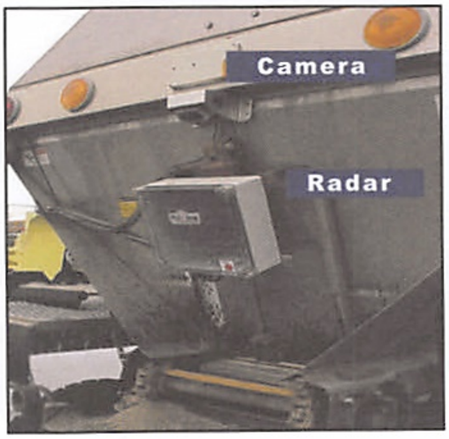
8. Radar/Sonar and Cameras

Radar and sonar systems function best when coupled with camera technology. The radar or sonar sensing devices send an alarm when an object enters their sensor field. The alarm alerts the operator to look into the monitor to see the person or object in the blind spot.

9. Tag Systems (RFID – Radio Frequency Identification)

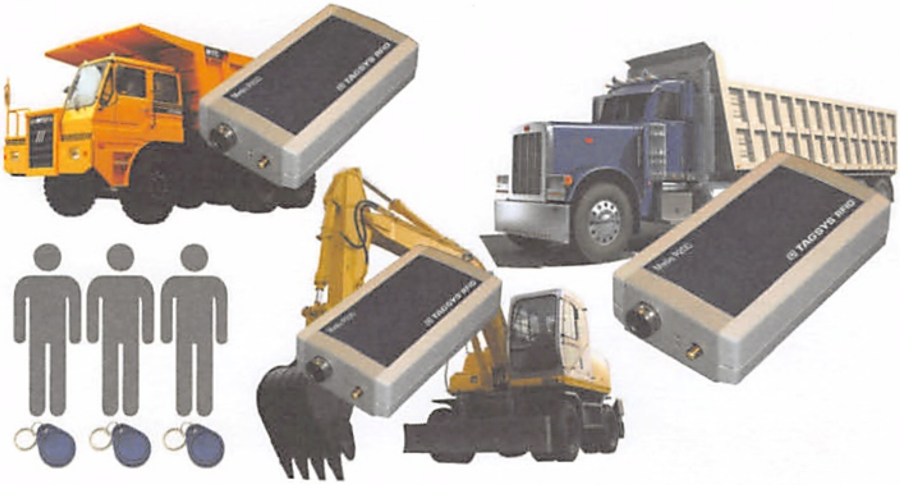
An emerging technology with effective results in other industries involves two-way communication between a system mounted on equipment and detectors on workers (or other machines). This is known as a 'Tag Based' system.

TAGSYS RFID



As a technology, RFID (Radio Frequency Identification) shows a lot of promise. The radio frequency transceivers are mounted on heavy equipment and/or light vehicles, and the tags are placed on the workers on foot. The location displayed is determined by the RF unit that detects the tag. The range is adjustable.

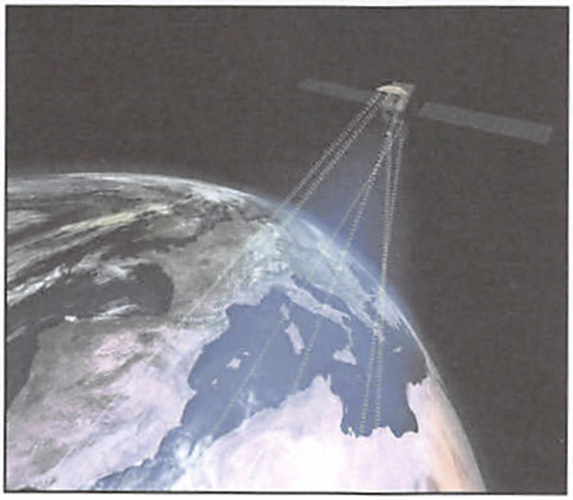
Some systems have a two-way alarm warning feature, which enables both the equipment operator and the worker to receive individual warning alarms. The driver receives an alarm from a device installed in the truck cab, and the worker receives an alarm from a device or tag worn on his/her belt.



Tag systems offer the most comprehensive collision avoidance protection because they alert both the driver/operator and the worker on foot when they are in close proximity to one another. Tag systems are often used in combination with cameras.

10. Global Positioning System (GPS)

Like the GPS device used for finding addresses or locations, equipment or vehicle locations can be determined using GPS. The GPS is installed on the equipment (dump trucks, pavers, rollers). The location of equipment is broadcast to other nearby equipment or to workers. Proximity warning alarms are sounded and locations displayed to warn of hazardous situations.

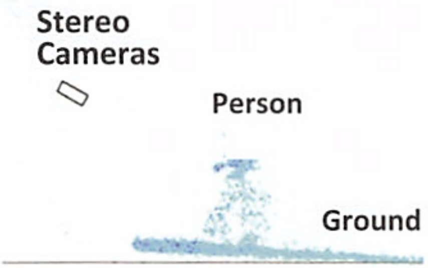


There are several challenges for GPS systems

- GPS receivers must be installed on all workers
- GPS is slower than other technologies presented – signal must go up to satellite and back to earth

11. Emerging Technologies

Other relatively new technologies show promise for our industry. One is an Intelligent Video System which uses computer-assisted stereovision cameras. The video signal processing allows for detection based on 3D position and provides a view of the blind area near equipment and proximity warning using only cameras. The image here is a sample of the camera and a person as he/she appears in the monitor.



MOBILEROBOTS

12. Additional Work and Considerations

As with any technology, special consideration must be given for the location and manner in which a technology will be used. There is a balance between using technology and distracting the operator with too many interfaces. Here are considerations.

- Reduce nuisance alarms and false stops
- Effective alarm presentation and context considerations
- Operator interfaces and combined displays
- Are systems overloading operators? Are they distractions?
- Behavior changes in operators
- Wearable sensors appropriate for tasks and the environment

13. Resources

NIOSH Proximity Detection Web Page
http://www.cdc.gov/niosh/mining/topics/ProximityDetection.html

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